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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Textile Machinery Lubrication

The Effect Upon Power Economy

PUBLISHED MONTHLY BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

Texaco Lubricants
FOR TEXTILE MACHINERY

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(Continued on inside back cover)

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Textile Machinery Lubrication

The Effect Upon Power Economy

IN the textile industry there is marked opportunity for wasteful consumption and improper usage of power, by reason of the wide variety of machinery involved and the frequent intensity of the operating conditions, for the all important factor in this industry, as in virtually any other, is the maximum of production wherever possible, at minimum cost. The extent to which power consumption may affect this latter, however, is very often lost sight of, for on any individual machine or part thereof it may be extremely small.

From a cumulative point of view, nevertheless, it may amount to quite a considerable item over a year's time. As a result, power consumption should be given very careful consideration.

Power consumption is, of course, materially influenced by the extent to which friction is reduced between the moving elements of any machine or, in other words, the degree to which effective lubrication is maintained.

Some extremely interesting studies have been carried out in this regard, to prove this point, especially in connection with spindle operation. Heavy duty machinery, however, can be studied quite as easily as the spinning frame. It is only a matter of the installation of proper power measuring instruments to determine the relative consumption of power entailed by the use of various grades of lubricants.

This matter of choice of lubricants, of course, must be studied with due consideration of the design of the moving elements, the extent to which they will be able to retain oil or grease, and the manner in which any such lubricant can be applied. The anti-friction bearing, for example, if properly designed to retain lubricant, can be depended upon to give extremely reliable and economical service, with but a minimum amount of attention on the part of the machine operator. There are certain types of automatic pressure lubricators which are also extremely dependable, although as a general rule, they will require somewhat more attention and perhaps a certain amount of adjustment.

Of these latter, the mechanical force feed oiler and the spring type, constant pressure grease lubricator have been proven adaptable. On the other hand, their usage or, in fact, the application of any automatic means of delivery or circulation of lubricant, will depend upon the design of the elements to be served. Spindles, for instance, are practically self-lubricating, provided the oil level is maintained at a certain pre-determined height in the bearing well. As the spindles rotate, this oil is automatically circulated.

When we realize that such elements may revolve at speeds of from 8,000 to 15,000 r.p.m., it can be appreciated that such means of lubrication are very dependable. The amount of frictional drag developed by the oil will depend, however, upon the inherent lubricating ability of this latter.

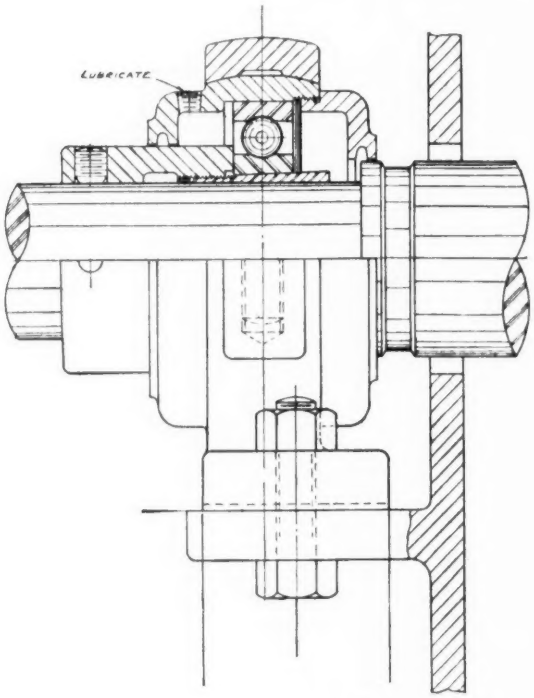
This has been taken up in further detail in a later part of this article.

NECESSITY FOR POSITIVE LUBRICATION

In a study of textile machinery lubrication, it is important to remember that a wide variety

of conditions may prevail to lead to difficulty in lubrication.

In the cotton industry, for example, there will be a considerable amount of dust, fluff and perhaps dirt. This will be especially true in the preliminary handling of the cotton by the opener, or the bale breaker. It may, however, extend through the mill to the cards.



Courtesy of The Transmission Ball Bearing Co., Inc.

Fig. 1—Showing details of a beater shaft of a Kitson picker. Note points of lubrication above bearing, and relative volume of the space available for lubricant, with respect to the size of the bearing.

Material of this nature is not exactly abrasive, but can be decidedly non-lubricating, in that it may impair free flow of lubricant to all parts of bearings. As a result, its presence must be anticipated by the designer, and bearings planned accordingly. In other words, there must be adequate provision to prevent abnormal entry of such matter, and means installed for positive delivery of lubricant. Obviously an oil hole would not serve the purpose for any length of time, inasmuch as it would very soon become partly or entirely filled with such foreign matter.

In the beginning, of course, this would serve to filter the oil. Ultimately, however, it would become so matted as to markedly interfere with flow of oil to the bearings. Furthermore, it would lead to a sloppy condition on the top of the bearings and around the machine.

In the average textile mill, the condition of comparatively high temperatures must also frequently be considered. This will prevail on the tentering frame, certain types of calenders, and other machinery used for the finishing of cottons, silks, woolens and worsteds.

High temperatures, of course, may lead to overheated bearings, but only where these latter are not properly lubricated. If an adequate supply of oil or grease of heat resisting characteristics is maintained, there will be but little to fear from the average temperature which will prevail in the textile industry.

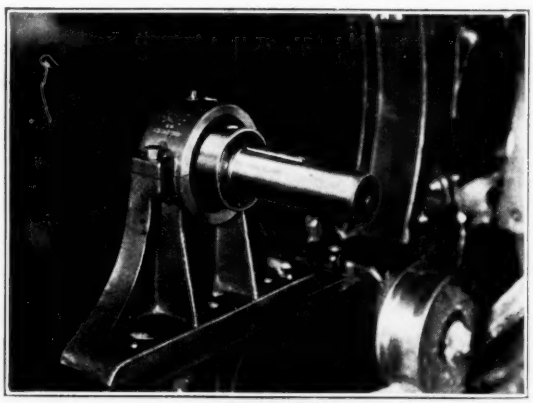
These latter may sometimes run as high as 250 to 300 degrees Fahr., at the bearing, depending upon the nature of the steam used. There is also the possibility of open flame, as in the tentering machine or singeing device.

In the dye house, or adjacent to the fulling machine in the woolen or worsted industries, there will also be the possibility of water having some effect on lubrication. It is, therefore, essential to bear this in mind, when selecting lubricants for bearings or gears of the machinery involved.

Wherever it is found that water may gain access to the moving parts, the lubricants should be of such a nature as to develop a certain amount of emulsion. It has been found that this latter will more effectively resist the washing-off effect of water, and more positively protect the wearing elements.

DEVELOPMENT OF TEXTILE MACHINERY LUBRICATION

It is interesting to note that in the use of mineral oil as a lubricant the textile industry ante-dates the actual commercial production of petroleum by more than twenty years. Mention of this is made by Bone.* He states that —"In the year 1845, Mr. Lewis Peterson, Sr., of Tarentum, Allegheny County, Pennsylvania,



Courtesy of The Fafnir Bearing Company

Fig. 2—Showing the main cylinder of a card, equipped with ball bearing pillow blocks. Note the compactness of this installation, and the degree of cleanliness attainable by the use of a properly housed bearing.

*J. H. A. Bone, "Petroleum and Petroleum Wells."

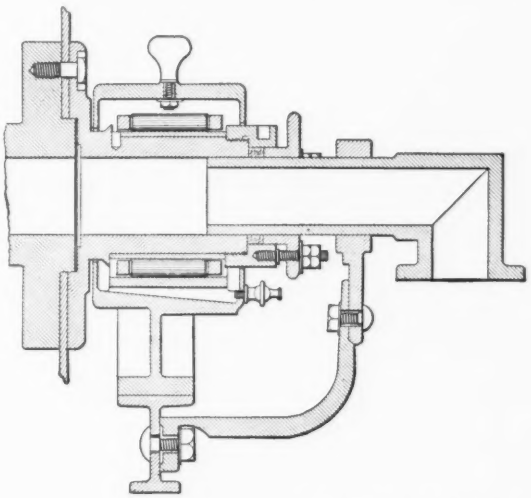
brought to the Hope Cotton Factory, at Pittsburgh, a sample, in a bottle, of what is now known as petroleum. It came up with the salt water from his salt well at Tarentum, and gave him considerable trouble. . . . The Manager of the Spinning Department, Mr. David Anderson, experimented with the oil and soon found that by a certain process it could be combined with sperm oil in such a way as to form a better lubricator for the finest cotton spindles than the best sperm oil, which alone could previously be used for that purpose. The mixture cost about seventy cents per gallon, whilst the sperm oil alone cost one dollar and thirty cents. The saving was so great in one of the heavy items of expense in a large cotton factory, that a contract was entered into with Mr. Peterson, by which the latter was to supply two barrels per week, and for ten years this oil continued to be used at the Hope Cotton Factory, unknown to any but the proprietors."

From this early development, petroleum lubricants have played a decided part in enabling the textile industry to become one of the major factors in the progress of modern comfort and decorative art, until today, from the viewpoint of power consumption, it is the second largest in the United States alone.

Materials as Well as Machinery Require Consideration

In studying any phase of the textile industry from a lubrication and power economy point of view, the nature of the product must, of course, be considered, for the potential possibilities will be influenced by the type of machinery involved.

In the handling of cotton there will not be much opportunity for economy prior to roving or spinning. In the operation of bale breakers, cards and combing machines there are comparatively low speeds involved and the rough nature of the cotton does not require as much care and accuracy in handling as in spinning and subsequently in weaving.



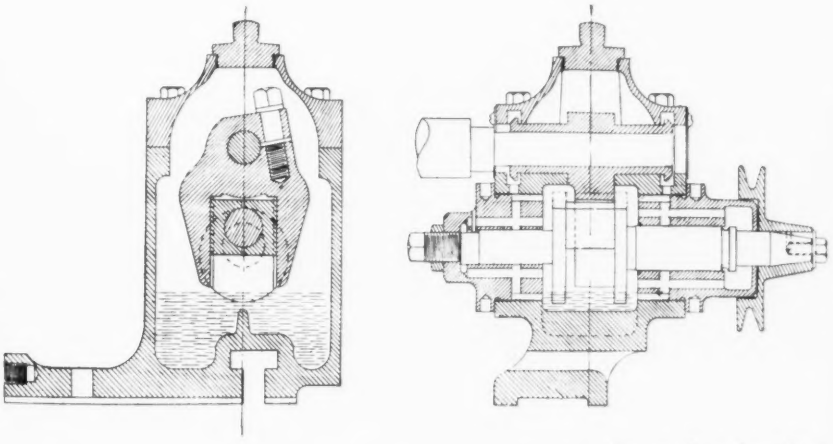
Courtesy of Saco-Lowell Shops

Fig. 4—Section through a slasher cylinder equipped with roller bearings. It is important to remember that such bearings must be most carefully lubricated in view of the fact that they are subjected to heat from the steam line which is carried through the cored-out cylinder.

On the other hand, in the handling of silk or rayon goods, from the very beginning the product must be regarded as extremely fragile, requiring the utmost care.

All this must be borne in mind in the original selection of lubricants for the machinery involved, as well as their subsequent application, for not only must all moving parts be protected against development of friction and wear as far as possible, but also oil staining of the goods must be guarded against at all times.

The importance of the entire matter of lubrication can best be realized by a detailed study of operating conditions of the various machinery and the requirements which they may impose on the lubricant. It is, therefore, fitting to discuss these in detail.

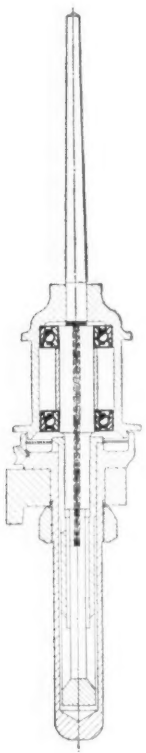


Courtesy of Saco-Lowell Shops

Fig. 3—Showing a sectional view of a comb box, illustrating in detail the design and location of the respective moving parts. The oil level in the box is shown by dotted lines.

OPENING MACHINERY IN THE COTTON INDUSTRY

In the cotton mill the first machine wherein any lubrication is involved is the bale breaker. The purpose of this machine is to tear the compressed material into tufts by means of rapidly revolving aprons and cylinders, equipped with protruding spikes. After passing through the breaker, the material is passed to a series of so-called lapping machines, which not only beat out any dirt and foreign matter which may be contained by the stock, but also compress this latter into a sheet of batting.



Courtesy of Norma-Hoffmann Bearings Corp.

Fig. 5 — Showing ball bearings applied to a high speed twister spindle. Note that a wick oiling system of lubrication is involved in this design.

The entire purpose of so breaking up the stock and then compressing it is to completely draw out the fibres and remove all dirt as far as possible. All this takes place in what is known as the Opening Room.

The essential problem in lubrication of opening machinery as a general rule, is to maintain frictional temperature as low as possible for, by reason of the usual amount of dust contained by the atmosphere, any spark might result in a blaze which would travel through the entire room. As a result, every care must be given to lubrication.

Anti-Friction Bearings Advantageous

It is for this reason that such equipment is frequently supplied with anti-friction bearings. By virtue of the care observed in the design and construction of such bearings, it is practicable to lubricate them with a minimum amount of lubricant. If the bearing housings are sufficiently tight, this latter should be a highly refined, straight mineral oil, of about 100 seconds Saybolt viscosity at 100 degrees Fahr.

If, on the other hand, there is any possibility of oil leakage, it will be well to consider the use of a grease. The possibility of contamination of the cotton at this early stage of treatment is rather remote, although it is just as well to eliminate any chance of oil leakage wherever practicable.

The lubrication of other working elements on such machinery can be effected by either oil or grease, according to the general construction of the machine and the means provided for application.

Gear Lubrication

Gears, however, should be given special attention, particularly if they are not adequately covered to protect the lubricant. In general, if a comparatively heavy bodied lubricant is used, a minimum amount will be required for the maintenance of a sufficient film on the gear teeth to not only prevent friction and wear but also the possibility of any spark, should the teeth happen to mesh or strike each other unevenly.

After the lap, or roll of cotton batting, has passed through the opening room, it is ready for the carding machine. This device is also used in the woolen and worsted industries for the opening out of the wool fibres after scouring. The essential purpose is the same in both industries; i.e., to render the fibres of the stock as nearly parallel as possible.

To bring this about, the stock is passed between further rollers and cylinders, surfaced with numerous small wire ends. The resultant product is known as the sliver. In appearance it resembles a form of rope.

CARDING OF COTTON AND WOOL

In the operation of a cotton, woolen or worsted mill the carding machine can be regarded as presenting the first real lubricating problem, by reason of the construction and motion of the comb box. The action of the doffer comb is vibratory, reciprocating motion being brought about by a suitable cam or eccentric mechanism. This latter runs in a bath of lubricant.

Due to the fact that the comb is usually set with but a few thousandths of an inch clearance between itself and the doffer cylinder, it is absolutely essential that the comb box be kept at an even temperature, to insure maintenance of this distance and even running of the sliver.

The Problem of Comb Box Lubrication

The successful lubrication of this box has always been a potential problem. Perhaps this has been chiefly due to the fact that textile engineers have been more or less in the dark as to the proper lubricant to use. Many have regarded grease or a fairly viscous oil as the proper lubricant. On the other hand, some greases are relatively inert. In addition, heavy greases and high viscosity oils will render it difficult to secure the low frictional temperatures which are so necessary.

The probable reason for this inherent preference of heavier or more viscous lubricants has been the necessity for preventing splashing or

throwing from the comb box where it is subjected to the continued churning action of the cam or eccentric mechanism.

Experiments with such equipment, however, have developed that the use of a lower viscosity lubricant will promote lower frictional temperatures and insure the maintenance of a more uniform clearance between the comb and doffer cylinder. Such a lubricant should be of the nature of a light to medium straight mineral oil.

The comb box must be kept in as perfect alignment as possible, for it must be remembered that a few thousandths of an inch out would involve a severe strain.

The size of the band must also be studied. If this is too small in diameter there will be a tendency to install it too tightly, with the result that both power consumption and temperature may be increased. By increasing the diameter, however, and deepening the Vees of the sheave wheels, this can be overcome.

Throwing and splashing of lubricants from the comb box is important in carding, due to the fact that the leather backing of the card clothing is susceptible to deterioration when spotted with mineral oil.

Cylinder Bearings

Cylinder bearings of a carding machine when they are of the plain bearing type can be effectively lubricated by a straight mineral oil of from 300 to 500 seconds Saybolt viscosity at 100 degrees Fahr. The utmost care must be taken, however, to prevent oil leakage from these bearings to the card clothing on the main cylinder.

For this reason, ball bearings have been experimented with and successfully applied to such card cylinder bearings. When installed in oil-tight housings, they effectively prevent leakage of lubricants to the card clothing. Furthermore, they materially reduce the starting torque, making it practicable to start a cotton or woolen card with a minimum of power, and practically no difficulty after shut-down.

When ball bearings are set in oil-tight housings a straight mineral lubricant of approximately 100 seconds Saybolt at 100 degrees Fahr. will give effectual service. In event of leakage being possible, however, it will be advisable to resort to a fairly heavy grade of grease.

TREATMENT PRIOR TO SPINNING

Following the carding of cotton or wool, the next treatment is drawing and additional combing. This is a process which is necessary prior to spinning, especially where the fibers of the stock must be subjected to further straightening to improve their texture and enable fine and even spinning.

In the cotton industry such treatment is known as combing or drawing, according to the lay-out of the mill, and the machinery involved.

Gilling and Backwashing of Wool

In the treatment of wool, the same results are accomplished by gilling and backwashing. Apart from the matter of stock conditioning or fiber lubrication, the use of oils on gill boxes involves but one possible difficulty; i.e., in regard to the drums or cans on certain types of the latter machines.

In other words, lubrication is a matter of judicious application of oils, greases or gear lubricants to the several bearings, driving chains and gears which are involved.

Temperature conditions are usually relatively high and it is frequently difficult to maintain the requisite film of lubricant within the clearance spaces. For this purpose a relatively inert lubricant, or grease of high melting point will be suitable, although it will be practicable in some cases to use a steam cylinder oil. Where such drums are eliminated, of course, the matter of lubrication is essentially simplified.

Courtesy of S. K. F. Industries, Inc.

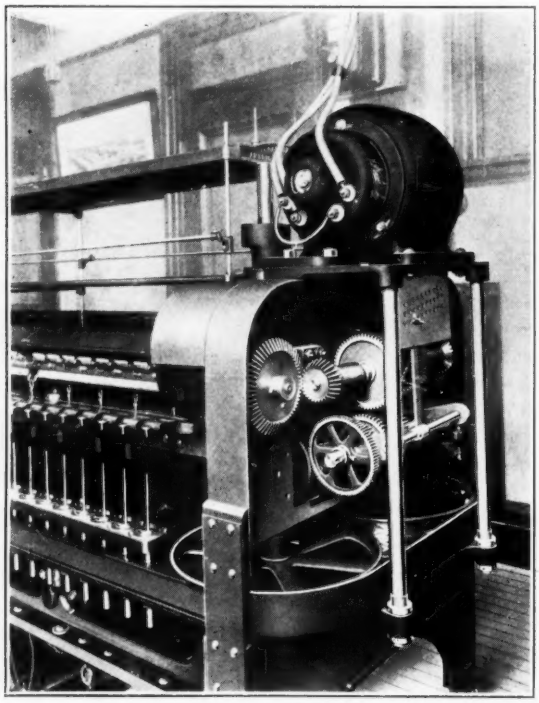
Fig. 6—Cut-away view of a roller bearing spindle, showing details of bearing construction and relative location of the moving parts of the spindle with respect to the base.

Combing Machine Lubrication

The comber, due to the proximity of its numerous intricate roll bearings, cams, etc., to the wool "tops," requires careful attention from a lubrication point of view. In selecting lubricants for such machines, the matter of body or viscosity will frequently be contingent upon the operating temperatures, for steam heat by means of an adjacent steam box is regarded as being of considerable advantage in bringing about efficient combing. As a result, especially on revolving table rollers and drawing off rollers, it will be necessary to use a lubricant of sufficient body to adequately resist the thinning out effects of the heat involved. A straight mineral oil of approximately 500 seconds Saybolt at 100 degrees Fahr. will usually serve the purpose satisfactorily. On the other hand, where grease lubrication is preferred, a comparatively light grease should meet the requirements.

Cam motions of a combing machine should

be lubricated with a comparatively heavy grease which will have sufficient body to resist the pounding of the dauber, and any tendency to drip or throw off. Daubing brushes in turn can frequently be served by a spindle oil of approximately 100 seconds Saybolt viscosity at



Courtesy of S. K. F. Industries, Inc.

Fig. 7—Drive end of a spinning frame, showing the respective gears involved, as well as a whorl drive.

100 degrees Fahr., although in many mills it is customary to use a light grease or somewhat heavier oil.

For the lubrication of bearings, however, a medium to heavy viscosity straight mineral oil can be used, especially if these latter are of the plain or sleeve type. With anti-friction bearings a somewhat lighter oil, as already mentioned in connection with opening machinery, should be used.

It must be realized that from the carding machine on, oil stains will become more and more of a problem. Once they occur their removal may involve considerable difficulty and perhaps loss of stock. There is some possibility of oil being thrown from the cam motions on certain types of combing machines.

DRAWING, ROVING AND SPINNING

The essential problems in the lubrication of drawing, roving or spinning frames, as well as of twisters (which serve to combine spun yarns for weaving) involve the spindles and variable speed rolls. Speeds are high, continuous operation is mandatory, clearances are low, and a minimum of friction is necessary to insure maximum production. Furthermore, the yarn must be protected against oil spots as much as possible. As a result all such machines require the most careful attention, and only mill mechanics conversant with the operating parts and the capabilities of the lubricants employed should take care of the lubrication.

Top Roll Bearings and Roll Stands

For example, take the front rolls of drawing frames through which slivers pass in the drawing and straightening process. The important item here is to lubricate with the maximum amount of protection to the leather coverings of the rolls. In other words, the lubricant must not creep from the bearings, otherwise the rolls might be ruined and the yarn stained.

The lubricant must therefore be relatively viscous in order to insure its retention in the bearings; at the same time, however, the presence of a small amount of soap will facilitate removal of oil spots in scouring and bleaching. For this reason a light bodied grease is preferred by many operators. This same lubricant is applicable to gearing and cam mechanisms, etc., although a somewhat heavier product would perhaps give greater economy.

SPINDLES

While roll bearings, gears, etc., are important features in regard to lubrication, the spindles are usually regarded as involving the outstanding problem due to the prevailing high speeds. As a result, the selection of a spindle oil is a most important item, for power and frictional losses must be reduced in every way possible, otherwise a considerable "drag" or excess of tension may be imposed on the yarn.

Test Data Indicates Power Saving

Some very interesting data has very recently been developed which indicates the possibility of marked power saving by special treatment of spindle oils and at the same time subjecting them to special refinement.

In the spinning department approximately 60 per cent of the total electric power used by the average cotton mill is consumed.

Where it is practicable to reduce this consumption it will, of course, be decidedly advantageous. With this object in view, some very exhaustive tests have been carried out, using a ring type, warp spinning frame, equipped with $1\frac{7}{8}$ inch rings and $8\frac{1}{4}$ inch bobbins. The spindles were driven at a speed of 9,200 r.p.m.

In order to develop as accurately as possible the actual effect which refinement and physical

characteristics might have upon power consumption, four different grades of oil were used. Prior to each test the spindle bases were pumped out and thoroughly cleaned. The spindles and bolsters were also carefully attended to.

Oil No. 1 was a highly refined, straight mineral filtered spindle oil. This product was run for two weeks, operating 24 hours a day, 6 days a week. The average power consumption was 20.6 watts per spindle per hour.

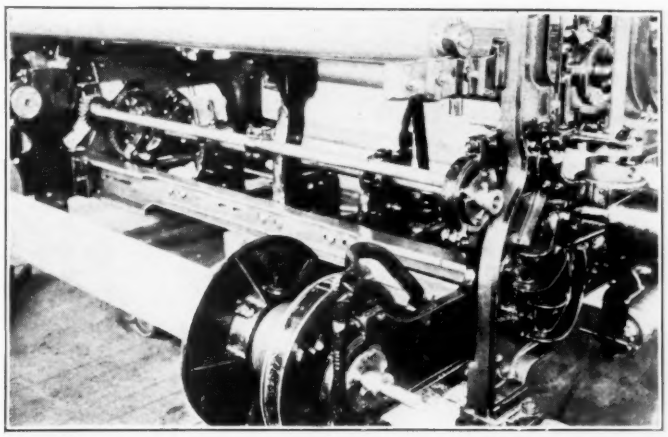
Oil No. 2 was especially prepared for this test. This oil was run for a two weeks' period, under as nearly the same identical conditions as the first oil. At the end of the test it was found that the average power consumption was 19.3 watts per spindle per hour. The operating temperature of the spindles was reduced about 2 degrees Fahr.

A particular advantage of this oil during this test was the fact that no oil stains were indicated on the thread over the test period.

It is interesting to note that there is but a very small difference in power consumption between these two oils. On the other hand, when it is taken into consideration that some plants operate upwards of 100,000 spindles, it can be appreciated that this would involve a reduction of power load of approximately 130 kilowatts per hour of operation.

In turn, oil No. 3 was subjected to a similar test. This oil showed a lower power consumption than either of the first two oils, but it was very soon apparent that it was not capable of withstanding high speed spindle operation. There was also some discoloration of the upper part of the spindle bearing and in two instances the spindles stuck in their bolsters.

The fourth and last oil to be tried was a very carefully manufactured product, having certain inherent characteristics which adapt it to high speed operation. The results of the test with this product were extremely gratifying, for very much lower power consumption was indicated than with any of the other three oils. In fact, at the end of the two weeks' test the average recorded power consumption was 17.8 watts per spindle per hour of operation. Furthermore, it was found that no staining had occurred during this time, and the operating temperature of the base was 5 degrees lower than with the first oil tried out.

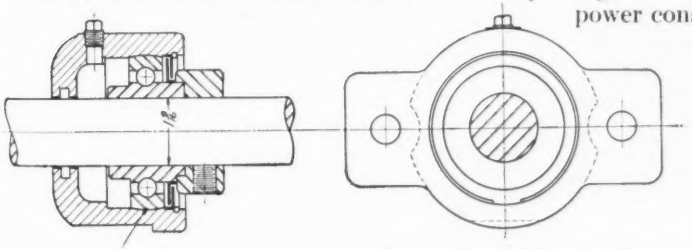


Courtesy of Crompton and Knowles Loom Works and S.K.F. Industries, Inc.

Fig. 9—Showing ball bearing application to the warp beam brackets of a loom. By use of such bearings cleanliness is improved, the necessity for attention reduced and more even rotation of the warp beam is attained.

As a result of this test, if we assume that a mill of 100,000 spindles was to use this oil under a weekly program of re-lubrication, the power saving involved would be approximately $19,000, whereas the increased cost of oil, plus labor, would not be very much over $1,000 per year.

Another interesting fact which developed during the above test was that power consumption varies directly with the degree of cleanliness of the spindle base. This may range from 0.3 to 0.5 watts per spindle per hour, depending upon the base. It is therefore evident that it is advisable to subject spindle bases to regular cleaning in the interest of reduced power consumption.



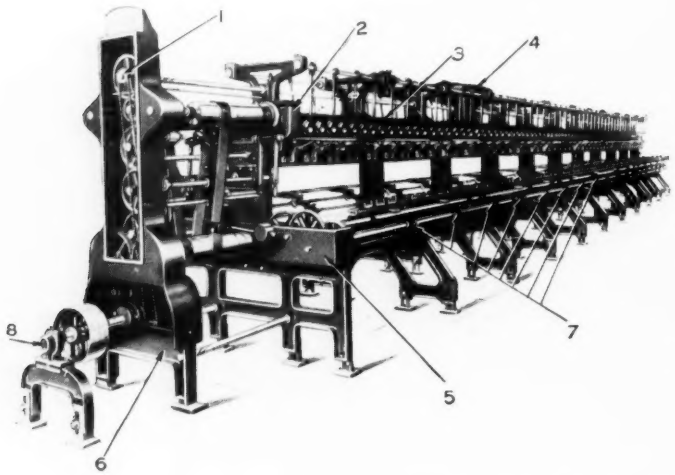
Courtesy of The Fafnir Bearing Company

Fig. 8—Sectional view of a Crompton and Knowles loom crank shaft, equipped with ball bearings. Note the means provided to prevent leakage of lubricant.

Temperature an Indication of Suitability

The suitability of a spindle oil can generally be noted by the temperature difference which exists between the spindles and the surrounding atmosphere. Under ideal conditions there should be no such difference. It is impossible, however, to eliminate friction absolutely, therefore spindles will usually be found to operate somewhat warmer than room temperatures. A difference of approximately 10 degrees Fahr. may be regarded as a fair average, using an average spindle oil.

Of course, the higher the viscosity of the oil the greater will be the internal friction, with the result that more power will be required to drive the spindles. For this reason every care should be taken to observe the above temperatures and reduce the viscosity of the oil as far as possible. On the other hand, this should not be carried to an extreme, otherwise there would be danger of metal-to-metal contact occurring. In this event, metallic friction would probably build up and excessive wear might occur. This would also be indicated by abnormal spindle temperatures, excessive power consumption, and perhaps ultimate seizing of the spindles. Long before this extreme, however, frequent breakage of the yarn would probably indicate that something was radically wrong.



Courtesy of Whitin Kohorn Co., Inc.

Fig. 10—View of a rayon spool spinning machine, designed for handling viscose. It is interesting to note that this machine is equipped with oil tight casings, in which the lubricating oils are carried to the moving parts by a pressure system inside the housings and also by gravity where the oil runs to the bearings through tubes from a chamber above. (1) indicates main drive, (2) the spindle drive, (3) the spindle gears, (4) the traverse, (5) the pump gears, (6) the oil pump, (7) plain bearings and (8) a ring oiled bearing.

It is essential, of course, to prevent spindle oil from coming in contact with the yarn as far as possible. Frequently, however, constructional details, carelessness or adverse operating conditions will render this ideal difficult to attain. As a result, it will be advisable at all times to use as light a colored mineral oil as is available.

Cleanliness Must Be Assured

Another important factor is cleanliness. We must remember that spindle oils should be very highly refined products, and that every care should be taken in refinement, handling and storage to keep them free from contamination. This care should be extended to the mill, and such oils should be stored in clean containers, free from dust and dirt, and handled only in clean oil cans.

It will also be advisable to clean out spindle oil reservoirs at frequent intervals and refill with fresh oil, as stated in connection with the above mentioned tests. Regardless of the means taken to prevent it, a certain amount of foreign matter will gain entry, to ultimately cause wear, increased friction, discoloration of the oil, and perhaps very serious staining of the yarn.

Other wearing parts of drawing, roving and spinning frames and twisters, such as gears, miscellaneous bearings, chain drives, etc., can be satisfactorily lubricated with either a 200 or 300 viscosity machine oil or medium bodied grease, according to requirements or the desire to concentrate on one lubricant. For enclosed chains and gears oil will usually be preferable, and probably the more economical due to the possibility of bath lubrication.

MULE SPINNING

In mule spinning the lubrication requirements will, in general, differ but little from those of the ring or cap type frames. Spindle problems are essentially the same, with the exception that the bases may be open. For this reason, due to the possibility of the occurrence of oil throwing, it will frequently be advisable to use a somewhat heavier spindle lubricant, it being, of course, necessary for the oil to remain in the base not only to insure positive lubrication, but also to prevent possible staining of the yarn.

For the rolls of the mule a light grease as recommended for ring or cap frame rolls would be suitable. Operating conditions and lubricating requirements are practically the same. Elsewhere on the mule a 200 or 300 viscosity oil or a medium bodied grease would serve the purpose, either being used judiciously, according to the mode of lubrication and the function or construction of the bearings, gears or chains involved.

SILK THROWING MACHINERY

In the silk throwing plant, lubrication of the various winding, doubling and spinning machines involves a number of problems, and the use of lubricants at any time that are improperly refined or otherwise unsuited for the service may result in much loss through damage to the silk.

The rapidly rotating spindles of the spinning and doubling machines require the most atten-

tion, due to their natural tendency to throw oil; hence, it is most important that they be looked after by an experienced machinist who understands the principles of lubrication. Spindle oil reservoirs should never be more than half full of oil, otherwise the latter will work itself upward to drip or be thrown onto the silk threads of adjacent spindles. In modern practice the self-oiling spindle is preferred by most throwsters due to its dependability.

Best practice is to oil spindles by removing them and carefully filling the reservoirs with oil to the desired level. No oil should be allowed on the outside of the spindle mechanism or on the driving belt. This must be guarded against, especially in replacing the spindles which should be done most carefully to avoid splashing or possible forcing of the oil onto the whorl or the belt. By many authorities it is considered good practice to renew spindle lubrication in sequence, and not oil all at approximately the same time.

For spindle lubrication, a comparatively light oil which has been highly refined to render it as nearly stainless as possible is advisable. Other working bearings of the spinning frame can be effectively lubricated by means of a high grade of machine oil of about 300 seconds Saybolt viscosity at 100 degrees Fahr.

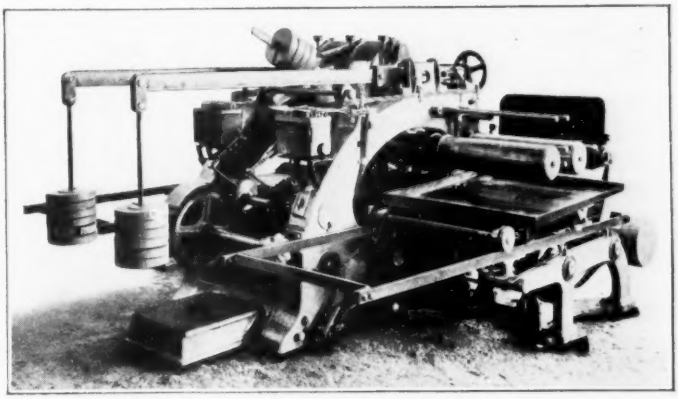
The throwster should never make the mistake of regarding frictional spindle drives as requiring lubrication. Trouble will be bound to occur if he does, not only from slippage but also from thrown oil. These should always run perfectly dry. Such gearing and silent chain drives as are installed should be sparingly lubricated by means of a relatively heavy grade of liquid grease that will not drip. Where ball bearings are installed on the heavy elements of spindle belt drives, etc., the lubricant should be a light bodied grease free from acid and alkali.

Slow Speed Machinery

Other throwing mill machinery, such as winding frames, doublers, reels, warpers and water stretchers, etc., operate at considerably slower speeds than do the spinning frames. They will normally give little or no lubricating trouble if the lubricant has been properly applied. Hand oiling of all bearings and gears is customary, and the machine oil and gear lubricant used in the spinning room will be suitable. There is comparatively little mechanism between the supporting frames of such machines which requires lubrication, hence the chance of damaging the silk by dripped oils is reduced.

Tram Rings

Tram rings, wherever installed, should be lubricated daily, using a light consistency and as nearly stainless grease as possible, which will keep the frictional temperature at a minimum.



Courtesy of Robert Bosch Magneto Company, Inc.

Fig. 11—View of a Mercerizing Machine, equipped with a Bosch system of centralized force feed lubrication. Note the lubricator with oiling leads attached at the top center of the machine.

These rings are an important part of the equipment and frequently may give rise to trouble due to the excess heat generated by virtue of the work they do. Their lubrication is best carried out by putting the lubricant in the palm of the hand and applying it to the rings with a finger, or flexible swab. The throwster should be careful to avoid excessive lubrication of such rings, since there will be a tendency of dirt and grit accumulating on the inside to possibly stain the thread.

Care of Belting

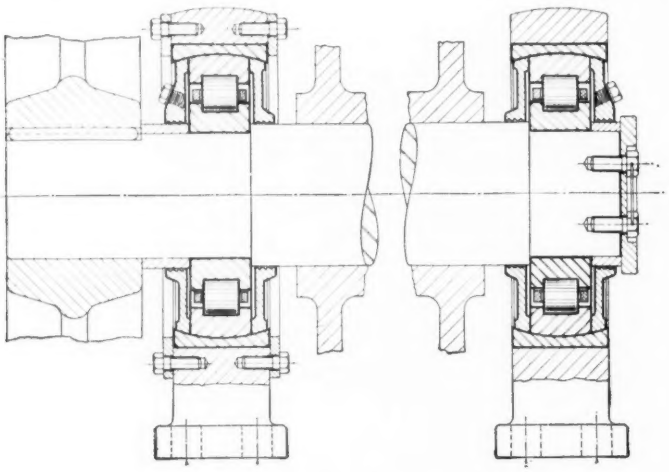
A word regarding the care of belts is also necessary. These should be kept absolutely free of oil and grease; else slippage and deterioration will be bound to occur. If they should become oily the free oil can usually be absorbed by holding chalk or whitening against the moving belt. Afterwards the surface should be carefully scraped with a dull knife.

WEAVING MACHINERY LUBRICATION

Lubrication of weaving machinery should be carried out with a view to preventing the oil from coming in contact with the yarn or goods at any stage of the process. In fact, by reason of the difficulties incident to oil stains, there is more or less of a tendency on the part of many mill operators to under-lubricate their equipment, thereby taking a chance on excessive wear. This is not advisable, however, provided suitable lubricants are chosen and properly applied. Best practice is to oil loom parts such as the picking motion once or twice daily. Other wearing parts, however, may be oiled less frequently.

Grades of Lubricants

On the other hand, the type, frequency and manner of lubrication will depend to a great extent upon the nature and construction of the wearing elements involved.



Courtesy of Norma-Hoffmann Bearings Corporation

Fig. 12—Showing the cylinder shaft of a napping machine, equipped with self-aligning roller bearings. Note that by use of side cover plates these bearings are complete units in themselves, inasmuch as the plates prevent entry of dust and foreign material, and insure the retention of the lubricant. There is an opening provided in each cover plate, through which grease may be supplied as needed.

For smaller bearings, a high grade machine oil of approximately 300 seconds Saybolt viscosity at 100 degrees Fahr. will be suitable. For lubrication of larger bearings, such as on rolls, the use of a somewhat heavier lubricant may be advisable, such as a good grade of light grease.

Gears and chains in turn will require considerable care in their lubrication to prevent dripping or throwing of the lubricant onto the woven goods. For this reason a fairly adhesive grease will generally give the best results, although it is perfectly practicable to use a relatively heavy oil if sparsely applied. Both gears and driving chains of the so-called silent type, if located in relatively oil-tight casings, will probably function best if lubricated with a straight mineral oil of approximately 100 to 150 seconds Saybolt viscosity at 210 degrees Fahr.

There is very little so-called automatic lubrication in the weaving mill, and hand oiling is still the prevalent custom. In some plants each machine operator is responsible for the oiling, operating and production of his own machine. It is usually best practice, however, to have lubrication taken care of by the loom fixers in charge of the section. By so doing there will be less opportunity of trouble occurring, and greater economy of oil will be attained.

Jacquard Machines

Jacquard machines require considerable care in their lubrication, and it is very necessary at all times that only the best grade of lubricant be used, and that it is applied by an experienced loom fixer. Oil should never be poured in excess upon the wires, cylinder hammers or other working parts of such a machine due to the fact that it will at best have a certain tendency to run or drip down onto the harness connections.

The presence of oil on these latter will tend to promote deterioration of the cords and result in breakage. In extreme cases such oil might even drip onto the warp or woven fabric, causing oil spots and perhaps ruining it, or in any event, entailing additional time and expense in subsequent removal.

Drip Must Be Prevented

For this latter reason, it is advisable to install oil pans upon the jacquard machine supports wherever possible and see that they are kept clean and free from dust and dirt at all times.

The lubricant for this purpose should be a light viscosity stainless textile oil or a high grade liquid grease. The latter is preferred by some authorities due to its non-dripping tendency. Many mill operators, however, use the same grade of machine oil as on the loom mechanism. In event of oil drip pans being installed, such a lubricant would serve the purpose quite well, yet there is still an element of danger attached in the possibility of oil spots occurring, whatever the precautions. Hence it is safest to use the more highly refined stainless oil or grease wherever possible.

LUBRICATION IN THE DYE-HOUSE

As is true in any other branches of the textile industry, probably the most important lubricating problem in the dye-house involves keeping the oils from coming in contact with the goods in any stage of the process. For this reason it is often customary to sacrifice lubricating efficiency to some extent, and many operators have a tendency to use heavier oils on certain bearings than would otherwise be necessary.

It is especially important in lubricating certain of the mechanism installed above the washing and coloring vats, to keep the oil from dripping into the liquid. The purest grade of water should be used in every process, and especially for washing. If oil were to drip into

the washing water it would almost surely result in ruined goods at some future stage of the process, inasmuch as the wash water is frequently used over and over again. For this same reason steam cylinder oils in the engine room should be applied somewhat sparingly, where the exhaust steam is used to heat the wash water. Oil separators should be installed, though they can not be depended upon to remove very low percentages of oils, which would still be detrimental to the goods.

Dye-house lubrication can normally be carried out with three grades of lubricants, i.e., cylinder oil, engine oil or grease, and a gear lubricant. Usually saturated steam under relatively low pressure is customary, and the steam cylinder lubricant is applied by some form of hydrostatic or mechanical lubricator. For this purpose a cylinder oil of from 130 seconds to 150 seconds Saybolt viscosity at 210 degrees Fahr. is best suited.

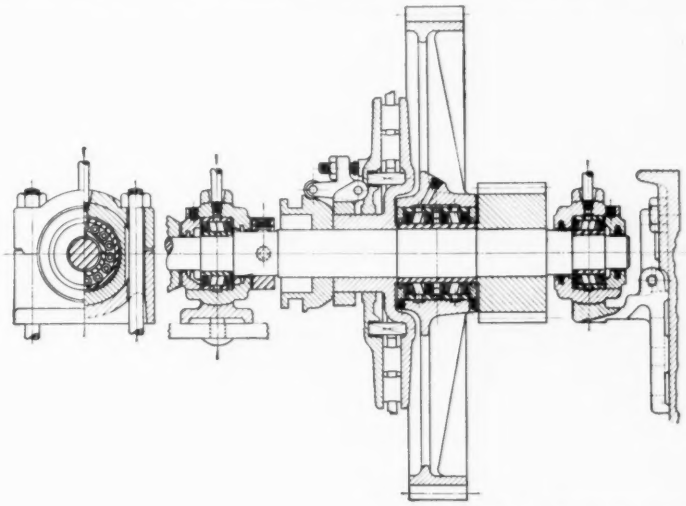
Bearing lubrication should be carefully carried out due to the detrimental possibilities of dripping, as mentioned above. Hand lubrication is usually customary on most dye-house apparatus. For this purpose a medium grade of grease is advisable.

Certain of the dyeing reels and driving apparatus on the rinsing vats are motor driven, through chains or gearing. There is considerable possibility of the lubricant used on these parts being thrown off onto the goods by centrifugal force. Therefore, it should be selected for its adhesive properties and applied sparingly and evenly. A straight mineral gear compound of approximately 1000 seconds Saybolt at 210 degrees Fahr. can be used here.

Other accessory apparatus in a dye house such as electric motors, air compressors, steam engines and hydro-extractors, should be lubricated in the usual manner for such equipment. Extractors are similar to those used in the steam laundry. Air compressors in particular require careful lubrication if water is to be pumped from wells by compressed air. The use of excess oil in the air cylinder may result in a certain amount of this oil ultimately becoming entrained in the water and damaging the goods in subsequent operations.

FINISHING MACHINERY

The lubrication of finishing machinery will, in general, involve the same essentials as discussed under weaving, spinning, etc. The problem is distinctly a dual one of machine lubrication and cloth protection. For this reason the same careful judgment in selecting and applying lubricants should be exercised as has been urged heretofore in this article.



Courtesy of Hyatt Roller Bearing Company

Fig. 13—The auxiliary drive of a worsted loom, showing the manner in which the Hyatt type of roller bearing can be applied.

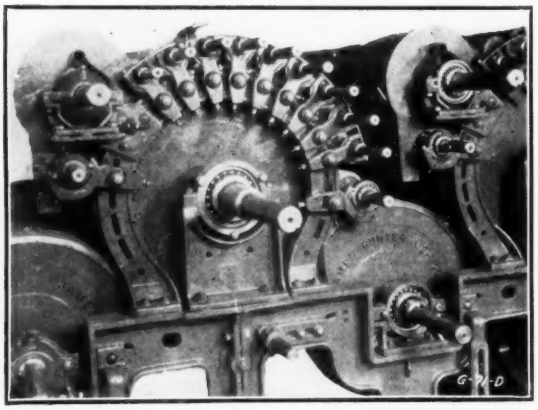
In the case of scouring and fulling machinery, the possibility of soapy water, etc., penetrating to the roll bearings and perhaps washing out the lubricant must be guarded against. Lubrication can of course be best effected if the bearings are properly constructed and adequately protected. On the other hand, this is not always the case. We must remember, too, that either oil or grease can be used according to the provisions for lubrication. Grease would perhaps best meet the exacting conditions of uneven pressure and possible washing. For this purpose a product composed of a nonsoluble soap will usually be most satisfactory. Its consistency should be that of a medium compression cup grease. On the other hand, where ball or roller bearings are installed, a more fluid product would be better, similar to a medium liquid grease.

Where oil lubrication is required for plain bearings, a 300 to 500 viscosity straight mineral product will probably meet conditions satisfactorily. In the case of ball and roller bearings either grease or oil can be used, according to bearing design and operating temperatures. Here it is quite as much a problem of protecting the balls, rollers and raceways from corrosion as of reducing friction.

The wearing parts of other machinery employed in raising, napping, cropping, singeing and pressing, etc., can usually be effectively lubricated by oils or greases of similar characteristics as above, according to the nature

of their construction or the means involved for lubrication.

The finishing room will usually be subject to somewhat higher temperatures than elsewhere in the mill, due to the use of steam and gas



Courtesy of James Hunter Machine Company

Fig. 14—Section of a two cylinder Garnett Machine, showing the manner in which ball bearings can be employed.

heaters, hence we must take this factor into consideration as well as the possibility of damage to the goods. Use of too light a lubricant on the tentering frame or ironing and pressing machine roll bearings, for example, might not only lead to abnormal wear due to lack of body in the lubricant, but also to a certain amount of sprayed or leaked oils contaminating the goods with oil spots.

STORAGE AND HANDLING OF LUBRICANTS

It must be borne in mind, however, that regardless of how carefully a lubricant may have been selected for textile mill service, or how effectively it may be applied to the machinery involved, if it is handled and stored in a careless manner prior to usage, many of the potential benefits to be derived may be lost.

While but casual mention has been made heretofore in this article as to the complications which may result from dirt, water or other foreign matter gaining entry into certain of the lubricating systems, it must be borne in mind that this is a very important factor to take into consideration.

Every mill should therefore make a careful investigation of oil storage facilities and not rest assured that as long as machinery apparently functions effectively there is no cause for worry.

LUBRICATION SERVICE

Every cooperation in this regard is offered through the service of a competent lubricating engineer. As a result, he should be of considerable value in this matter of attaining effective lubrication by the solution of individual lubricating problems in any mill. The wrong impression of such service should never be gained. There are too many who are so short-sighted as to be prejudiced, holding the opinion that such service is merely cut and dried sales talk, to further the use of some particularly expensive lubricant which may be on the market.

Such a program, however, is farthest from the ideas of the reputable concerns in the oil industry. Their ideal is to give every client the benefit of their experience with the various grades of lubricants adapted to machinery such as his; to instruct him in the proper method of carrying out lubrication and, whereever possible, to recommend the installation of more efficient means of lubrication or method of storage prior to usage. To appreciate his problems and to tell him how to avoid them by the proper use of the right lubricant is the real aim of lubrication service.

It is reasonable to expect that the more receptive the manager of any mill may be to such advice, the better operation will he probably derive from his machinery. In fact, it amounts to a matter of having confidence in your Lubricating Engineer just as you would in your Doctor. He will save you money in the long run, even though it may sometimes call for a slight addition to the present cost of operation, or increase in capital investment, where replacement of the lubricating system may, for example, be advisable.

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